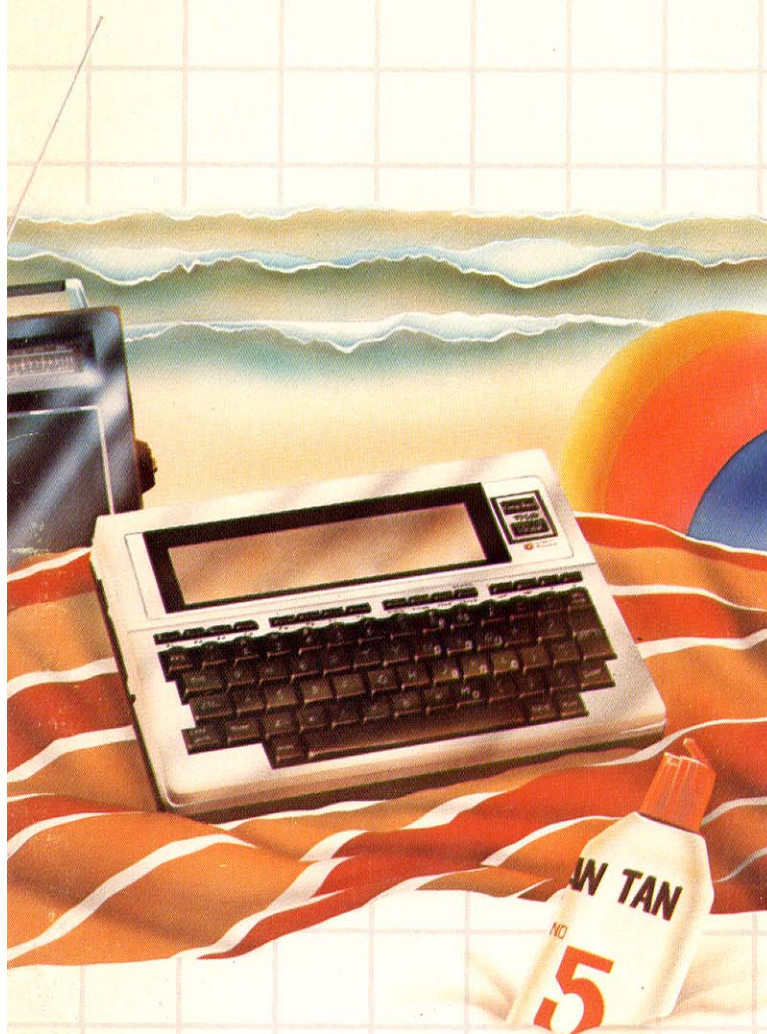


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HOW TO USE THE **TRS-80** **MODEL 100[®]** **PORTABLE COMPUTER**

Basic Instructions on Set-up, Expansion,
Applications, and Maintenance

An Alfred Handy Guide



by Robert K. Loudon

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AN ALFRED HANDY GUIDE

Series Editor
George Ledin Jr.

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1. FEATURES OF THE MODEL 100

INTRODUCING THE TRS-80 MODEL 100

The TRS-80 Model 100 is the lap-sized portable computer from Radio Shack. This Handy Guide will describe the features of this popular new computing system, explain why it is a unique addition to the world of personal and small business computers, and show how you can use its built-in programs for word processing, appointment scheduling, telephone communications, and computations in the BASIC programming language.

Radio Shack Computers and the Tandy Corporation

The first personal computer by Radio Shack, a division of the Tandy Corporation headquartered in Fort Worth, Texas, was the TRS-80 Model I in 1977. Many hundreds of thousands of TRS-80 computers have been sold since then through almost nine thousand Radio Shack stores and computer centers. The TRS-80 Model 100, unique because of its light weight and portability, is one of the latest in a large, successful family of personal computers.

Small versions of the original TRS-80 Model I consisted of a typewriter keyboard for typing in data and commands to be executed, a video display resembling a television screen upon which results were displayed, and a tape cassette recorder to store data and programs. Larger versions included an expansion box containing additional memory and up to four separate floppy disk drives to store the data and programs. These components were connected by wires and cables like the components of a stereo music system.

Memory in the TRS-80 Model I consisted of two types: ROM (Read Only Memory), used to store programs that would not be changed, and RAM (Random Access Memory), used to store data and programs for temporary use. When the computer was turned off, the RAM memory was erased, but the contents of the ROM memory were available the next time the computer was turned on.

Memory size is measured in bytes. One byte can store one character, such as one of the letters A through Z or the digits 0 through 9. The biggest TRS-80 Model I contained approximately 16,000 bytes of ROM memory plus 48,000 bytes of RAM memory. These sizes were called 16K ROM and 48K RAM, where K stands for one thousand. The biggest Model I thus contained a total memory of about 64K. The floppy disks on the Model I could each hold about 90,000 bytes.

The TRS-80 Model I was followed by the Model II, a business-oriented machine with up to 64K bytes of RAM and larger disk drives. Later came the Model III, which was essentially a Model I with higher capacity disk drives repackaged into a single case to eliminate the many boxes and wires that characterized the Model I. The Model III, like the Model I, had about 16K bytes of ROM plus 48K bytes of RAM for a total of 64K bytes.

Now comes the TRS-80 Model 100 (see Figure 1.1), which also contains a maximum of 64K bytes, just like its predecessors. The difference is that the Model 100 takes up a small fraction of the space required for the older machines; it weighs about 10 percent as much as they did and runs on four small AA batteries, whereas the earlier models required significant amounts of 120 volt electricity from the nearest wall socket. That's progress!



The TRS-80 Model 100: a Truly Portable Computer

Many personal computers on the market today claim portability, but the Model 100 really has it! Where others weigh 20 to 30 pounds, the Model 100 weighs less than four pounds, or about as much as a good-sized book. Where others fill up the space under an airline seat, the Model 100 is only eight-and-a-half by eleven inches, the same size as a sheet of notebook paper, and fits handily inside almost any conventional briefcase. Where others require 120-volt power cords, the Model 100 can operate for up to twenty hours on its four small batteries. When you're traveling, you can operate the Model 100 in taxis, limousines, airplanes, and even boats. With most of the others, you'd have to wait until you could plug in to the wall in a hotel room or office.

(Airline use of the Model 100 may be limited in the future. Uncertainty over the possible effect of the port-

able computers on airline navigational instruments caused some airlines to ban the use of such computers in 1983. Other airlines continued to permit the in-flight use of computers. Check the current policy of the airline of your choice before using the Model 100 in the air.)

The true portability of the Model 100 greatly increases its usefulness, particularly for travelers. The Model 100 fits nicely on your lap and works for you in your favorite chair, outside under a tree, on the beach, or even in bed. With this computer you can make full use of such normally unproductive periods as automobile and train rides. Many people have found that the Model 100 provides a sense of freedom that makes personal computing worthwhile for them for the first time.

MODEL 100 HARDWARE FEATURES: MEMORY

Personal computers, including the Model 100, have hardware and software. *Hardware* is the computer and its accessories, while *software* is the library of programs or computer commands that actually tell the computer what to do. The Model 100 comes with a large amount of permanently built-in software.

All Model 100s come from the factory with thirty-two thousand bytes or characters of ROM memory. That's more than twice as much ROM as any previous member of the TRS-80 family of computers. This big 32K ROM memory comes loaded with all of the programs needed for the primary Model 100 applications, such as text editing, appointment scheduling, maintaining address and telephone number files, telephone communication, and BASIC language programming. The many programs in the ROM memory never change; they are all always available in their original form from the moment you turn on the computer.

The remainder of the memory in each Model 100 is RAM. The RAM memory ranges in size from eight thousand bytes (8K) to a maximum of 32K bytes. RAM is used to store the programs and data that you write through your keyboard or load in from another computer, possibly over telephone lines. The contents of both the ROM and RAM memories in the Model 100 are preserved while the computer is turned off, but you can change the RAM memory contents by storing new data or programs whenever you want to. Obviously the more RAM memory you have, the more data and programs you can take along inside your computer.

How much RAM, then, should you get with your Model 100? Although the 8K size is adequate for learning about computers and their capabilities, the 24K or 32K sizes should be ordered for business use, particularly if you plan word processing of large documents.

How much will all this cost? The 1984 prices for the Model 100 complete with various RAM memories are:

Model 100 with 8K RAM memory	\$799
with 24K RAM memory	\$999
with 32K RAM memory	\$1,133

Secondary Memory Options

In addition to the ROM and RAM memories inside your Model 100 you will eventually need some kind of secondary memory. Why? To store programs and data for future use after you have filled up the RAM memory of your Model 100. Some programs and reports that you write can be erased from RAM memory and discarded after they are transmitted or printed, but others will be useful later. You'll want to keep them, but you won't want to keep them inside your Model 100 because you'll need its memory for new projects. So where can you file the old projects to make room for the new ones, while still being able to retrieve the old projects and load them back into your Model 100 later? In some kind of secondary memory, that's where.

The least expensive kind of secondary memory is the tape cassette recorder. Radio Shack recommends their model CCR-81 cassette recorder, which comes complete with cables to attach to the Model 100, and costs \$59.95. The tape cassettes are inexpensive, and a single cassette can contain the contents of an entire 32K RAM memory. However, they are not fast, even though they operate at about 150 characters per second; it takes several minutes to dump or reload your memory onto a cassette. The CCR-81 is almost as big as the Model 100; a smaller microcassette recorder should be available soon. Like almost all cassette recorders, the CCR-81 will run on batteries, and that's a decided advantage. It would be a shame to take along a battery-powered computer like the Model 100 and then have to go looking for a wall outlet every time you wanted to save a program on tape.

If you have access to another computer with disk drives, you can use the other computer as your secondary memory. All you have to do is plug the two computers together, either directly or over the telephone lines, and then send your old programs and data from your Model 100 to the other computer for storage on the other computer's disk drives. Details of this operation are discussed in Chapter 5.

If you can afford the cost, you might consider using one of the national or international computer networks as your secondary memory. Examples of these networks are CompuServe and The Source. These networks consist of big central computers with disk drives, connected to local telephone numbers in cities throughout the United States and overseas. The time you spend connected to these networks will cost you five dollars an hour or more, plus additional charges for the space you use on their disks. However, they can store more data than you will ever need and they are always as near as the nearest telephone. Particularly if you travel a great deal, you might want to consider storing your programs and data

in the network computers. You may also find suitable local networks run by computer hobbyists available at lower costs. Network operations are discussed in Chapter 5.

Another possibility is to attach disk drives directly to the Model 100. A disk video interface is available for \$799 which includes one disk drive plus a television adapter. A second disk drive may be added for an additional \$239. Each five inch floppy disk used in these drives can hold 184K bytes of data. The television adapter gives you a bigger screen size: 24 lines of 40 characters each.

OTHER FEATURES

The Keyboard

The Model 100's keyboard is one of its strongest features. It consists of a full-size keyboard like a typewriter for word processing, plus eight function keys, four command keys, and four keys to control the position of the cursor on the screen. The cursor is a small square that indicates where the computer will place new characters as you type them in via the keyboard.

A total of 256 different characters can be generated by various keyboard combinations; 224 of these can be displayed on the screen. The characters include uppercase and lowercase letters and numbers as well as various graphics and foreign language characters.

The function and command keys perform different roles, depending upon which application program is currently in use. Basically, the function and command keys enable you to select options and make decisions with a single keystroke. Without these keys you would have to type in command names, which takes a lot longer.

The Screen

The screen on the Model 100 consists of an eight-line by forty-character liquid crystal display called an LCD. The LCD provides a total of 320 characters on the screen, which seems to be adequate for most word processing applications. The characters are quite large; they are about a fifth of an inch in height at a vertical spacing of only four lines per inch, compared to six lines per inch for most typewriters. The large size makes them easy to read, particularly if your eyesight isn't perfect. The characters are well formed with good descenders; this means that letters like the lowercase *g* and *j* extend below the other characters, as they should. Not all portable computers have this typographical capability.

Each character on the screen is formed from a pattern of rectangular dots, eight dots high by six dots wide. The dots can be individually controlled by BASIC programs to create graphs, maps, and other patterns on the screen. The screen thus contains 240 dots in each row by

64 dots in each column for a total of 15,360 programmable dots. Graphics programming is discussed in Chapter 6.

A thumbwheel on the right side of the computer housing allows you to rotate the screen slightly for maximum contrast and readability. This is important, because LCD screens operate from reflected light, and that light must reflect back into your eyes. The angle of reflection between your eyes and the keyboard must be right and the thumbwheel allows you to make fine adjustments. One result of this arrangement is that you can use the Model 100 at a variety of angles on your lap or on a table in front of you. Another result is privacy; people sitting next to you probably can't read your screen because the reflection angle won't be right for them.

The LCD screen doesn't generate its own light, so you can't use it in a dark room or outside at night. But if you have enough available light to read a newspaper, you have enough light to use the Model 100.

Input and Output Ports and Controls

The sides and back of the Model 100 contain several sockets where other devices may be attached: a bar code reader interface, a tape cassette port, a telephone port, a parallel printer port, an RS-232C serial port, and an external power connector. All of these sockets are present and operational on all Model 100s; they are not options.

The bar code reader interface, designed to read the bar codes used to price items in supermarkets and for similar applications, accepts a wand, which can be passed over printed bar codes so that the Model 100 can read them. Special bar code programs are needed to translate the bar codes. This interface could be used in the future to distribute programs in bar code format. Such programs would be printed on a sheet of paper and could be duplicated on an office copier and read directly into the Model 100 using the optional bar code wand.

The tape cassette port accepts the cable from compatible cassette recorders and controls the recorder during recording and playback operations.

The telephone port accepts a Radio Shack telephone cable (\$19.95), which attaches conventional telephones at one end and the Model 100's built-in direct-connect auto-dial telephone modem at the other end. The auto-dial modem enables the Model 100 to talk to other computers on the telephone. In addition, the Model 100 can look up phone numbers in its memory and dial them for you, either immediately or at a programmed later time, using its standard real-time clock. Telephone transmission proceeds at about thirty characters per second, which is about as fast as you can read data displayed on the screen.

The parallel printer port allows you to attach any of a large number of computer printers marketed by Radio Shack and other suppliers, ranging from daisy wheel printers for letter-quality output to high-speed matrix printers and multicolor pen plotters. The printers allow you to save hard-copy printouts of the program, text, and

data files stored inside your Model 100. A Radio Shack printer cable costing \$14.95 is needed to attach any of these printers. The printer port is quite fast; the Model 100 can drive most printers as fast as they can go. Chapter 7 explains printers in more detail.

The RS-232C serial port permits direct attachment of the Model 100 to other nearby computers having an RS-232C capability. What does RS-232C mean? It is simply the name of a standard format or protocol for data communications. This transmission, either to or from the Model 100, may proceed at speeds of up to 500 or 1,000 characters per second. Large files can be loaded or unloaded to another computer in a few seconds using the RS-232C.

Batteries and External Power Connectors

The external power connector accepts Radio Shack's AC Adapter/Charger, which costs only \$5.95, and allows you to plug the Model 100 into a 120-volt AC power source. This extends the life of the four AA batteries, but does not recharge them. What is recharged is the Ni-Cad battery inside the Model 100, which serves as a backup for the AA batteries. The Ni-Cad battery preserves the RAM memory contents of the Model 100 for up to one month after the four AA batteries are discharged, and the Ni-Cad can then be recharged from either an AC Adapter/Charger or a new set of four AA batteries.

A red light to the right of the screen when you turn on the Model 100 means that the AA batteries are low. When you see this light, you should turn off the computer as soon as you can and proceed to replace the four AA batteries. If you have a 32K RAM memory, the Ni-Cad battery will keep your memory intact for about eight days. If you have only 8K of RAM memory, the Ni-Cad can keep your memory for about 30 days.

BOOKS AND PERIODICALS COVERING THE MODEL 100

Several magazines devote all or part of their coverage to the Model 100. A big monthly magazine covering all of the TRS-80 computers is *80 Micro*, which contains a monthly section devoted to the Model 100. This section, called "C-Notes," usually contains about twenty pages of BASIC programs and advertisements specifically about the Model 100.

A smaller monthly magazine covering the whole TRS-80 family is *Basic Computing*, which usually devotes several pages to Model 100 programs. Both *80 Micro* and *Basic Computing* are available through local computer stores or by subscription.

A new magazine devoted to the TRS-80 family of computers and containing articles about the Model 100 is *Computer User*, which started publication late in 1983.

Two new magazines dedicated entirely to the Model 100 are *Portable 100* and *Briefcase Portable*. These mag-

azines may be hard to find in the stores, but advertisements for subscriptions to them can probably be found in *80 Micro*.

CARING FOR YOUR MODEL 100

The Model 100 requires very little care, but what care it does require is very important.

First, replace the AA batteries when they run down. Keep a spare set of four on hand and replace them promptly. Working for a long period of time with run-down AA batteries can lose the contents of your RAM memory and shorten the life of the backup Ni-Cad battery as well.

Second, keep dirt and liquids out of the case in general and the keyboard in particular. The Model 100 is likely to encounter more dirt than most computers because its portability allows you to take it into unfriendly environments. Keep your Model 100 in its vinyl case or in a briefcase when it's not in use to minimize dust and grit in the keyboard. Be careful not to spill drinks into it. At the beach, watch out for blowing sand or rain.

Third, try to store it at a temperature that you yourself can tolerate. Although the Model 100 can be stored at temperatures of up to 160°F, the top of a dashboard in a closed car on a sunny day, for example, could exceed even those limits.

WHAT HAPPENS WHEN YOU TURN IT ON

Now let's turn on the power on/off switch located on the right side of the Model 100 case. Most computers, when turned on, simply tell you that an operating system or some other control program is ready. The Model 100 is much more friendly than that; it automatically displays a main menu showing all of the application programs in ROM memory plus all of your programs and data files in RAM memory. Just move the highlighted or shaded cursor with the four cursor control arrow keys to the program or text file that you want, press the ENTER key and you are immediately running that program or editing that file.

Incidentally, if you don't see the Model 100 main menu on the screen after turning it on, the most probable reasons are that no AA batteries have been inserted, or the main memory power switch located on the bottom of the Model 100 has not been turned on. This switch should be turned on and left on as soon as the AA batteries are installed. Turning it off erases all RAM memory.

Setting the Time and Date

The first time you turn on your Model 100, you must set the time and date, which are displayed at the top of the screen. Once set, the time and date should maintain

themselves indefinitely unless the batteries become completely discharged.

Turn on the Model 100 to display the main menu. If the word BASIC is highlighted by the cursor, press the ENTER key. If not, move the cursor via the cursor control keys until BASIC is highlighted. Then press ENTER.

Now you are in the BASIC language program and your screen should look like this:

```
TRS-80 Model 100 Software
Copr. 1983 Microsoft
29381 Bytes free
OK
```

The number of bytes free shown above is for a 32K RAM system; if you have less than 32K RAM you will see a smaller number.

Now type in

```
time$="HH:MM:SS"
```

where HH is two hours digits from 00 to 23, MM is two minute digits from 00 to 59, and SS is two second digits from 00 to 59. Then press ENTER. For example,

```
time$="14:45:00"
```

will set the time to 2:45 p.m. Note that the Model 100 uses a twenty-four-hour time display.

Now type in

```
date$="MM/DD/YY"
```

where MM is a month from 01 to 12, DD is a day from 01 to 31, and YY is a year from 00 to 99. Then press ENTER. For example,

```
date$="04/05/85"
```

will set the date to April 5, 1985.

Next type in

```
day$="DDD"
```

where DDD is one of the abbreviations Mon, Tue, Wed, Thu, Fri, Sat, or Sun. Then press ENTER. For example,

```
day$="Tue"
```

will set the day to Tuesday.

Now, to check the time you have just entered, type

```
? time$
```

and then press ENTER. The updated time will be displayed.

To check the date, type

```
? date$
```

and then press ENTER. The date will be displayed.

To check the day, type

```
? day$
```

and press ENTER and the day will be displayed on the screen.

Now we are ready to proceed with the major application programs.

2. THE TEXT PROGRAM

TEXT is the name of the text-editing program in the ROM memory of the Model 100. Many owners consider it to be the most useful (and most used) program in the Model 100 program library. How do you turn TEXT on? Just turn on the computer, watch the main menu come up on the screen, drive the cursor over to the word TEXT with the cursor control keys, press the ENTER key, and you're running the program. That's the real power of the integrated software library built into every Model 100: the programs are always ready to go immediately after a single selection from the main menu.

WORKING WITH THE TEXT PROGRAM

Naming Text Files

If you previously edited a text file in RAM memory and you want to work on it some more, just drive the cursor to the name of your file on the main menu, press ENTER, and you're editing that file with the TEXT program.

Let's assume that you want to create a new text file. You drive the cursor to TEXT and press ENTER. The screen goes blank and then the message "File to edit?" appears at the top of the screen. Suppose you want to call this new file MEMO. If so, type in MEMO in either capitals or lowercase letters and press ENTER.

Now the screen goes blank once again and a shaded block, which is the text editing cursor, appears in the upper left-hand corner. You are now ready to put some text into the file called MEMO.

File names, such as MEMO, are limited to a maximum of six characters in the Model 100, and the first character of the file name must be a letter. When a text file name appears in the main menu, the computer will automatically add ".DO" to the name to indicate that this file is a document or text file. The MEMO file will appear in the main menu as MEMO.DO for this reason.

Function and Command Keys for the TEXT Program

Before typing in your memo, press the command key called LABEL just under the screen. The functions assigned to the various function keys are now displayed at the bottom of the screen. They are:

Key F1	Find words or phrases in the text file
Key F2	Load a file from a cassette recorder
Key F3	Save a file to a cassette recorder
Key F5	Copy the selected text at the cursor
Key F6	Cut the selected text out of the file
Key F7	Select text to be cut out or copied
Key F8	All done; return to the main menu

Besides the eight function keys below the screen at the left, you also have four command keys to the right of the eight function keys. The command keys are labeled as follows:

PASTE	Inserts text that has been cut
LABEL	Causes display of function key labels
PRINT	PRINTs the screen (if printer attached)
BREAK	Cancels current operation (see below)

The LABEL key can be pressed whenever you are unsure of the number of one of the function keys. Pressing LABEL again will remove the function key label display so as to create more space on the screen.

Entering Text

Now let's enter some text. A major advantage of text editing is the way you can add text anywhere. For example, you can write the last paragraph of your memo first and then add paragraphs above the last one to support its conclusions. Type five spaces (for paragraph indentation) and then the following:

Based on the above considerations, I am sure
that you agree we should set up an office in Denver
as soon as possible. Please call me today on this.

Then press ENTER to end the last sentence, ENTER again to get an extra blank line, hold down the space bar to space over to the right side of the line, and type your name. Press ENTER again. Notice how all the keys repeat if you hold them down; this makes underlining and spacing over to the right easier. Notice also how the text automatically wraps itself around to the next line, ending each line at the end of a word or a sentence. Remember that you press ENTER to end a line only if that line is the end of a paragraph, file, or part of a table.

Inserting Text from the Keyboard

If we want to be critical, there are at least a couple of things wrong with the text you have just entered. Instead

of “Based on,” you should have written “Based upon.” How can this be fixed? It’s easy. Just drive the cursor with the cursor control keys until it is on top of the *o* in “Based on.” Then just type in the two letters *u* and *p*. That’s all there is to it!

For another example, let’s say “you agree that we” instead of “you agree we.” Again, drive the cursor over to the *w* in “we.” Type in “that,” being sure to type a space after “that.”

The Model 100 TEXT program is always ready to insert text anywhere in the text file. Just position the cursor and type away. Occasionally, when you are inserting text near the beginning of a long text file, you may find yourself typing faster than the computer can insert the characters on the screen. If this happens, don’t worry. The computer will catch up as soon as you stop typing and no characters will be lost.

Deleting Characters One at a Time

Notice the key in the upper right-hand corner of the keyboard labeled DEL BKSP. This key can be used to delete individual characters from the text. To see how this works, press the DEL BKSP key once. Notice that the character immediately to the left of the cursor was erased or deleted. Repeated pressings of DEL BKSP will delete several characters. Holding down the DEL BKSP key will delete several characters very rapidly.

The most obvious need to delete characters to the left of the cursor occurs when you have just made a typing error and want to correct it immediately. All you have to do is to backspace over it and the error is erased.

Suppose you want to delete characters at or to the right of the cursor instead of to the left of the cursor? That’s easy, too. Just hold down the SHIFT key while pressing DEL BKSP. Notice that DEL BKSP deletes or erases characters to the left of the cursor, while SHIFT DEL BKSP deletes characters under and to the right of the cursor.

Positioning the Cursor

So far we have been moving the cursor using only the cursor control keys, and this has worked reasonably well because we are editing a very small text file. The SHIFT and CTRL keys are available to make bigger cursor moves when they are needed in larger files. Table 1 describes the cursor movements available when the SHIFT or CTRL keys are pressed together with the cursor control keys.

Remember that for a text file smaller than the screen, the top of the screen and the beginning of the file will be at the same place, and the bottom of the screen and the end of the file will also be at the same place.

Find: Words or Phrases in Text Files

Although the cursor control keys are useful in positioning the cursor to insert or delete text, a more powerful tool

TABLE 1. Editing with the Cursor, SHIFT, and CTRL Keys.

DIRECTION	CURSOR KEY	SHIFT+ CURSOR	CTRL+ CURSOR
Right	Next character	Next word	Right end of line
Left	Last character	Last word	Left end of line
Up	One line up	Screen top	Start of file
Down	One line down	Screen bottom	End of file

is needed to position the cursor in large text files. That tool is the Find function.

Move the cursor to the beginning of your text file by pressing CTRL together with the UP cursor control key. Then press function key F1. The word "String:" now appears in the lower left-hand corner of the screen. Any string of characters, such as a word or phrase or even a single letter, is called a character string.

Type in "agree" and press ENTER. The cursor instantly jumps to the word "agree" in your text file. You are now ready to delete the word "agree" and insert something else in its place. Proper names can be found just as fast; you could as easily have found Smith if that name was in your file. The Find function is very fast even on large text files, much faster than similar functions on microcomputers using much more power and space than the Model 100.

Now press function key F1 again. The "String:" message now includes the word "agree"; you are ready to find the next occurrence of "agree" in your text file if there is one. Press ENTER. The message "No match" now appears in place of the "String:" message. No second match for "agree" was found; there is only one occurrence of the string "agree" in your text file.

The steps in using the Find function are:

1. Move the cursor to the top of your text file.
2. Press function key F1.
3. Type the string to be found; then press ENTER.
4. Press function key F1 and ENTER to find the next occurrence of the same string in the file.

Select: Text to be Cut or Pasted

A more powerful method of deleting and inserting text is provided by function key F7, which selects text to be cut out or deleted for later insertion elsewhere in the text file. Move the cursor to the beginning of the word "Please" in the text file. Now press function key F7. Move the cursor a few characters to the right. Notice how the cursor is leaving a trail of shaded characters behind it. This shaded block of characters has been selected for future copying or cutting.

Move the cursor to the end of the sentence. The whole sentence "Please call me today on this." should be shaded. In this way words, phrases, sentences, para-

graphs, or larger blocks of text may be quickly selected for cut and paste operations.

When selecting a block of text to be cut out, you can start at either the right end or the left end of the block and move the cursor toward the other end to define the shaded area. All the cursor control key combinations may be used to increase or decrease the size of the shaded block of text on the screen. The Find key (function key F1) may also be used to position the cursor at the end of the block.

A selected block of text may be any of the following:

1. A single character
2. All or part of a line on the screen
3. A sentence
4. A paragraph
5. All text up to a word you have found
6. All text above the cursor to top of the file
7. All text below the cursor to end of the file

If you change your mind after selecting a block of text, you may cancel the selection by pressing the **BREAK** command key, followed by pressing the **SHIFT** and **PAUSE** keys together.

The steps in selecting a block of text are:

1. Move the cursor to one end of the text block.
2. Press function key F7 to begin selection.
3. Move the cursor to the other end of the block.
4. Examine the shaded area on the screen to make sure that you have selected the text correctly.

Cut: Text Out of a Text File

After selecting text to be cut as described above, look to make sure that the shaded part of your file is the part of the file that you want to cut out. Then press function key F6. The shaded text disappears from the screen and the remaining text flows together to eliminate the hole where the selected text appeared before it was cut out.

The text you have cut out is not necessarily lost forever. The last selected area that you have cut out is retained in memory so that you can paste it into a new location in your text file. Read on for details.

The steps in cutting out text are:

1. Select a block of text using function key F7.
2. Move the cursor to shade the selected block.
3. Check the shaded area for correctness.
4. Press function key F6 to delete shaded text.

PASTE: Text Into a Text File

Now move the cursor to the beginning of your file. Then press the **PASTE** command key. Immediately the sen-

tence "Please call me today on this." appears at the beginning of the text file. You have "pasted" it into a new location. It is still available to be pasted into other locations as well until you erase it by selecting and cutting another block of text.

This pasting technique can be used to move text from one file to another. Simply Select and Cut a block of text from one file. Then press function key F8 to return to the main menu. Next move the cursor to the name of another text file and press ENTER to begin editing the new file. The block of text can still be inserted into the new file by moving the cursor to the desired location in the new file and pressing the PASTE command key.

The steps in pasting text into a file are:

1. Select and Cut a block of text.
2. Move cursor to the new location of the block.
3. Press the PASTE command key.
4. Repeat steps 2 and 3 to paste the same text into several different locations.

Copy: Text to Another Place in a Text File

Frequently you will want to copy or duplicate a block of text from one location in a text file to another location in the same file or a different file without erasing or deleting text at the original location. This can be done using the Copy function or function key F5.

Select an area to be copied exactly as though you were going to cut it out of the file. Then press function key F5. Although nothing changes on the screen and the shaded text is not erased, a copy of the shaded text is now ready to be "pasted" in wherever you want it to appear. The Copy function works just like the Cut function except that the shaded area is not cut out of the file; it is simply saved for subsequent PASTE operations.

The steps in copying text into a file are:

1. Select and Copy a block of text.
2. Move cursor to the new location of the block.
3. Press the PASTE command key.
4. Repeat steps 2 and 3 to paste the same text into several different locations.

SAVING OR DELETING TEXT FILES

Saving a Text File into the Model 100 Memory

Remember that text files are automatically saved into the Model 100 RAM memory as you type them into the keyboard. You can turn off the Model 100 any time, even in the middle of a sentence, and the text that you typed in will still be there when you turn the computer back on hours or days later.

That's one of the reasons why the Model 100 is a uniquely practical computer: its owners are immune to the horrors of 120-volt power outages. (If you've ever been editing a text file on a 120-volt microcomputer when the lights went out, then you know what horror really means.)

You don't have to do anything at all to save files into the memory of the Model 100, because as you type them in, they're already there. You've got to be careful of your RAM memory files, though, because they're usually the only copies of the files that you have. On a system with disk drives you could reload a backup copy from disk if you accidentally cut a big piece out of the file in RAM. In the Model 100 there usually is no backup copy. You should make one for important documents as early as possible.

Save: Text Files to a Tape Cassette

When the RAM memory on your Model 100 gets full you must either kill some of your files to make space in RAM memory or else save one or more files in some kind of secondary memory. The least expensive secondary memory is the CCR-81 cassette recorder described in Chapter 1.

And how do you know that the RAM memory is getting full? The number of free bytes or characters of RAM is displayed in the lower right-hand corner of the main menu. When this number gets low, you've got to save or delete one or more files.

First you must connect the cassette recorder to the Model 100. The Radio Shack recorder-to-computer cable, which comes with their CCR-81 cassette recorder, has a large plug on one end and three small plugs on the other end. Connect the large plug to the socket labeled CASSETTE on the back side of the Model 100. Connect the small black plug to the EAR socket on the cassette recorder. Connect the larger of the two small grey plugs to the AUX socket on the cassette recorder. Then connect the smaller of the two small grey plugs to the REM socket on the cassette recorder.

The REM socket stands for remote control, which allows the Model 100 to start and stop the cassette recorder as needed during recording and playback. Some cassette recorders do not have a remote control capability; these recorders cannot be used with the Model 100.

After connecting the recorder, insert a tape cassette to receive the saved text file. Make sure that the beginning of the text file you want to save is on the screen; if not, press function key F8 to get to the main menu of the Model 100, move the cursor to the name of the text file you wish to save, and press ENTER.

Now press the RECORD and PLAY buttons on the recorder simultaneously. Don't bother with the recorder volume; it is set automatically during recording. Press function key F3, and the message "Save to:" will appear at the bottom of the screen. Now type in a file name of six characters or less. The new file name will be the name

of the file on the tape cassette. It can be the name you used on the Model 100 or any other name you choose. Then press ENTER.

The cassette recorder will now start turning automatically and will stop after the file has been recorded. The recording takes place at about 150 characters per second; a document of fifteen to twenty thousand characters (like one of these chapters) will thus take about three minutes to save on a tape cassette.

For valuable documents it is good practice to save two copies, one after the other, on the same tape cassette, using two different names. For irreplaceable documents make two copies on two different cassettes.

To recap, the steps to save a text file are:

1. Attach the recorder cable.
2. Put a blank cassette in the cassette recorder.
3. Press the RECORD and PLAY buttons together.
4. Put the top of the text file on the screen.
5. Press function key F3.
6. At the "Save to:" message, type in a file name.
7. Press ENTER and wait until the recorder stops.

Load: Text from a Cassette

Loading a text file from a cassette recorder is similar to saving the file on a recorder. First attach the recorder cable, as explained above. Then rewind the tape cassette to the beginning. Make sure that you will be reading from the same side of the tape that you used in recording the desired file. The tape cassette has two tracks, one on each side, and each track can be used to store different files.

Now get the top of the file on the screen of your Model 100 by moving the main menu cursor to the file name and pressing ENTER. If the file to be loaded is a new file, go to the TEXT program from the main menu and name the new file.

Then press function key F2. The message "Load from:" will appear at the bottom of the screen. Type in the same file name that you used when the text file was saved on the cassette. Now press ENTER. The Model 100 will sound a high-pitched tone to indicate that it is searching the tape cassette for the file name you just entered. If other files are found on the tape first, they will be skipped over and a "Skip: (name)" message will appear on the screen. When the correct file is found, the message "Found: (name)" will appear and the file will be loaded into the Model 100's RAM memory.

All of this tape searching can take several minutes if several files are involved. For this reason it is more practical to get several cassettes and place only one or two text files on each cassette, being careful to label the cassettes so you will know which files they contain.

The steps involved in loading a text file are:

1. Attach the recorder cable.
2. Put a cassette in the cassette recorder.

3. REWIND the recorder.
4. Press the PLAY button on the recorder.
5. Put the top of the text file on the screen.
6. Press function key F2.
7. At the "Load from:" message, type the file name.
8. Press ENTER and wait until the recorder stops.

Killing a Text File in the Model 100 RAM Memory

Of course, once in a while you do want to remove or delete a text file from the RAM memory of your Model 100. How do you do it?

You go to the main menu, move the cursor to BASIC, and press ENTER. This puts you into the BASIC programming system, which will be covered in Chapter 6. Now type in KILL "NAME.DO", where NAME is the file name of the file you wish to delete. For example, to delete the file called MEMO you would type in KILL "MEMO.DO". It is not necessary to use capitals; lower-case letters are just as acceptable.

Don't KILL anything you might want to use later, however, because when you KILL it, it's really gone. If in doubt, save the file to a tape cassette.

FURTHER THOUGHTS ABOUT THE TEXT PROGRAM

Leaving TEXT

When you have typed in your entire document or reached a good stopping place, press function key F8 to return to the Model 100 main menu. Your text file will remain in RAM memory. Or, if you're in a hurry, you can just turn off the computer without going back to the main menu. Either way, your text file will be there when you need it in the future.

Driving TEXT with CTRL Key Combinations

Some writers prefer to keep their fingers on the typewriter keyboard to achieve maximum typing speed. These people avoid the use of the function, command, and cursor control keys as much as possible because they believe that these keys slow up their touch typing. To accommodate them, the Model 100 contains a large set of commands triggered by pressing the CTRL key in combination with one of the letter keys to move the cursor, cut, paste, and save text files on a cassette recorder. Most people find it easier to learn the TEXT program using the function and command keys, but if you want to use the CTRL combinations in order to type faster, they are shown in Table 2.

TABLE 2. CTRL Key Combinations.

CONTROL CODE	OPERATION PERFORMED
CTRL A	Move cursor one word to the left
CTRL B	Move cursor to bottom of screen
CTRL C	Cancel Select, Load, Save, or Find function
CTRL D	Move cursor one character to the right
CTRL E	Move cursor up one line
CTRL F	Move cursor one word to the right
CTRL G	Save (same as function key F3)
CTRL H	Delete one character to the left
CTRL I	TAB right (same as TAB key on keyboard)
CTRL L	Select (same as function key F7)
CTRL M	End of line (same as ENTER)
CTRL N	Find (same as function key F1)
CTRL O	Copy (same as function key F5)
CTRL P	PRINTer control code (see below)
CTRL Q	Move cursor to left end of line
CTRL R	Move cursor to right end of line
CTRL S	Move cursor one character to the left
CTRL T	Move cursor to top of screen
CTRL U	Cut (same as function key F6)
CTRL V	Load (same as function key F2)
CTRL W	Move cursor to beginning of text file
CTRL X	Move cursor down one line
CTRL Y	PRINT entire file (if printer connected)
CTRL Z	Move cursor to end of text file

The printer control codes initiated by CTRL provide for underlining and other special printer functions. These codes may be embedded in your text files to improve the appearance of your printed documents. See the Model 100 owner's manual for details.

Margins and Pagination

If you are an experienced word processor you'll notice that we haven't said anything about margins or pagination (numbering the pages), or how many lines to print per page, or several other things needed to do a really professional job of text editing. These capabilities are described in a BASIC formatted printing program in chapter 6.

Also, you have probably noticed that the relatively short forty-character lines of the Model 100 screen occasionally produce some pretty chopped-up sentences. Don't worry about that either; what counts is how the sentences look when they are printed, and the printing program in chapter 6 will take care of that.

A technique used by many Model 100 owners is to create and do preliminary text editing on the Model 100 and then transmit the text file to another computer for final editing and printing. Details of this approach are discussed in chapter 5.

If you aren't ready to concede that this is the most powerful text-editing system currently running on four

penlight batteries, then you'd better go back and read this chapter again.

3. THE SCHEDL PROGRAM

SCHEDL is the name of the scheduling program in the SROM memory of the Model 100. It's designed to record and retrieve the dates and times of appointments and events that you choose to type into your Model 100. For example, it can keep track of your expense account entries, lists of projects to be completed, your ancestors, club memberships, or even small inventories of parts on hand. How can SCHEDL do all these different jobs? Because it is really a simplified data-base management system, a powerful program for organizing and finding all kinds of data in the memory of a computer.

SCHEDL allows you to put any information you choose into a text file called NOTE. You can then find things in the NOTE file by matching characters, words, or phrases with the contents of the file. The contents of the NOTE file may resemble the notes that you would otherwise write down in a notebook, but the powerful searching capabilities of SCHEDL make it much more useful and interesting than the handwritten notebook approach.

HOW TO OPERATE SCHEDL

Creating the NOTE File in RAM Memory

Before you can use SCHEDL at all you must create a NOTE file of data to be searched. There can be only one file named NOTE in the RAM memory of the Model 100, although you could have several different NOTE files saved on a tape cassette, and use them to replace the NOTE file in RAM for different applications.

If you try to run SCHEDL before creating a NOTE file in RAM, you will get the message:

```
NOTE.DO not found
Press space bar for MENU
```

To create a NOTE file, go to the main menu, move the cursor to the TEXT program, and press ENTER. When you get the "File to edit?" message, type in NOTE and press ENTER. You are now ready to type some data into the NOTE file. The Model 100 will automatically add the characters ".DO" at the end of your file name,

so that it will appear in the main menu as the NOTE.DO file.

As an example, type in the following six lines, always pressing ENTER at the end of each line:

```
1/4 Call Susan re Murphy
contract
1/6 See Jim re Higgins Proposal
1/7 Dinner at Vanelli's with
Mary
1/8 Jim to Present Higgins
Proposal
1/12 Deadline for Higgins
Proposal
1/12 Follow up on Murphy contract
```

Now press function key F8 to get back to the main menu and we'll look at the capabilities of the SCHEDL program.

Function and Command Keys for the SCHEDL Program

Run the SCHEDL program by going to the main menu, looking to make sure that the NOTE.DO file is in the menu, moving the cursor to SCHEDL, and then pressing ENTER. The functions assigned to the various function keys are now automatically displayed at the bottom of the screen. They are:

Key F1	Find matching entries in the NOTE file
Key F3	More: display additional entries if any
Key F4	Quit: don't display additional entries
Key F5	Lfnd: find and print NOTE file entries
Key F8	All done; return to the main menu

The other function keys are not used by the SCHEDL program. Function keys F3 and F4 are only active during a Find function; these two keys do not have their functions displayed at the bottom of the screen until they are active.

Besides the eight function keys below the screen at the left, you also have four command keys to the right of the eight function keys. The command keys are not used in SCHEDL. As the function keys in SCHEDL are displayed automatically, it is not necessary to use the LABEL command key to display them.

Find: Schedule Entries in the NOTE File

If you have just started to run the SCHEDL program, you should see function keys F1, F5, and F8 displayed at the bottom of the screen and the message "Schd:" displayed at the top. If not, go back to the main menu, move the cursor to SCHEDL, and press ENTER.

Now press function key F1. The word "Find" appears after "Schd:" to indicate that we are about to do a Find

function. Now type in the word "HIGGINS". Immediately three lines are displayed on the screen:

```
Schd: Find HIGGINS
1/6  See Jim re Higgins Proposal
1/8  Jim to Present Higgins
Proposal
1/12 Deadline for Higgins
Proposal
Schd:
```

Notice that it makes no difference whether you type in higgins or Higgins or HIGGINS; the SCHEDL program searches for both upper- and lowercase letters corresponding to Higgins. Notice also that all three occurrences of Higgins have been found; in the TEXT program only the first occurrence would have been found and the cursor would have stopped at the first occurrence. The Find function in SCHEDL is a very fast way to find all of the references to any character, name, or phrase in the NOTE file.

The message "Schd:" after the line for 1/9 indicates that SCHEDL is ready to find another combination of characters. Now press function key F1. Then type "12" and press ENTER. The screen immediately displays:

```
Schd: Find 12
1/12 Deadline for Higgins
Proposal
1/12 Follow up on Murphy contract
Schd:
```

You have now found all the schedule entries for January 12.

Want to find the date and locale of your dinner with Mary? Press function key F1, type "Mary", and press ENTER. The screen now shows:

```
Schd: Find Mary
1/7  Dinner at Vanelli's with
Mary
Schd:
```

What happens if there is no match in the NOTE file for the word or phrase you are searching for? In that case, the "Schd:" message is simply repeated on the next line of the screen.

Remember that there is no prescribed format for the NOTE file. You can use foreign languages, put the date any place in each entry or leave it out entirely, or even express your numbers in Roman numerals. SCHEDL doesn't care what you put in the NOTE file or how you choose to arrange it. SCHEDL is only looking for a match for the particular string of characters that you typed in after hitting function key F1.

Scanning the Entire NOTE File

Now, with the "Schd:" message on the screen, press function key F1 and then press ENTER without typing in

any characters to be found. This causes everything in the NOTE file to be found and causes the entire file to be displayed on the screen. Thus, you can scan the whole file without going back to the TEXT program to do the same thing. If you want to change the contents of the NOTE file, then you must go back to the TEXT program to type in your new entries and delete the obsolete entries.

Using the More and Quit Function Keys

Notice that, after doing a Find function that displayed all six lines of your NOTE file, the words "More" and "Quit" are displayed over function keys F3 and F4. Whenever SCHEDL has six or more lines from the NOTE file displayed on the screen, it pauses to enable you to read the six lines. Then SCHEDL gives you the choice of seeing the next six lines (by pressing function key F3 for More) or stopping the search and returning to the "Schd:" message (by pressing function key F4 to Quit).

More and Quit give you the time you need to think about the information on the screen and then to decide whether or not to proceed to display more entries from the current search or to initiate a new search for entries in the NOTE file.

Using Special Symbols as Categories

Suppose that, without doing a lot of redundant typing, you would like to tag or code the entries in your NOTE file to identify them with different categories. The different categories could be different departments in your company, different product lines, or different sales regions. Or the categories could be as simple as top priority, middle priority, and low priority tasks you must perform. How can you do this?

You could code each top-priority entry with "@", each middle-priority entry with "*", and each low-priority entry with "&". Suppose you did that with the small NOTE file that we have been using in this chapter. The result, accomplished by using the TEXT program, might look like this:

```
@ 1/4  Call Susan re Murphy
      contract
* 1/6  See Jim re Higgins
      Proposal
@ 1/7  Dinner at Vanelli's with
      Mary
* 1/8  Jim to Present Higgins
      Proposal
* 1/12 Deadline for Higgins
      Proposal
@ 1/12 Follow up on Murphy
      contract
```

Now you could display all your high-priority items by simply doing a Find on the @ character alone. Not

much is gained by this approach in a file as small as our example, but a great deal might be gained in a much larger file with a large number of entries of different priorities.

Of course, if the categories were not exclusive, you could use multiple category symbols for a single entry in the file, if that entry belonged to several categories. The possibilities for cross-referencing and other data-base retrieval operations are limited only by your imagination (and the maximum RAM memory size of your Model 100).

In addition to appointment scheduling, other subjects for a NOTE file might include art collections and prices; ancestors, with the dates and locations of births and deaths; and club rosters, including information on which members had paid their dues.

Printing Selected Entries with the Lfnd Function Key

If you have a suitable printer attached to your Model 100 (see chapter 7 for printer information), then function key F5 will cause the entries found by the Find function to be printed on the printer instead of being displayed on the screen. All of the entries found will be printed; the Model 100 will not pause after every six lines when it is printing.

The printer option allows you to make many searches through your NOTE file and save the results of each search for later discussion with other people if necessary. That's the advantage of hard-copy or printed output: you can give it to others. Searches on the screen are for your information alone.

4. THE ADDRSS PROGRAM

ADDRSS is the name of the scheduling program in the ROM memory of the Model 100. It's designed to record and retrieve the names, addresses, and telephone numbers on an address file that you type into your Model 100. ADDRSS is very similar in both structure and operation to the SCHEDL program described in Chapter 3. The major difference between the two programs is the way telephone numbers are handled in ADDRSS so that they can be dialed automatically by the TELCOM program. The ADDRSS program is described in detail here for those readers who have not recently used SCHEDL.

ADDRSS allows you to put any information you choose into a text file called ADRS. You can then find things in the ADRS file by matching characters, words, or phrases with the contents of the file.

HOW TO OPERATE ADDRSS

Creating the ADRS File in RAM Memory

Before you can use ADDRSS at all you must create an ADRS file of data to be searched. There can be only one file named ADRS in the RAM memory of the Model 100, although you could have several different ADRS files saved on a tape cassette, and use them to replace the ADRS file in RAM for different applications.

If you try to run ADDRSS before creating an ADRS file in RAM, you will get the message:

```
ADRS.DO not found
Press space bar for MENU
```

To create an ADRS file, go to the main menu, move the cursor to the TEXT program, and press ENTER. When you get the "File to edit?" message, type in ADRS and press ENTER. You are now ready to type some data into the ADRS file. The Model 100 will automatically add the characters ".DO" at the end of your file name so it will appear in the main menu as the ADRS.DO file.

As an example, type in the following six lines, always pressing ENTER at the end of each line:

```
Jim Adams, 321 Main St.,
:1234567:
Susan Baker, 4321 Abernathy
Drive, :2345678:
Mary Madison, 123 E. 10th St.,
:3456789:
Police Department, 456 Chestnut
St., :1112222:
Fire Department, 567 Chestnut
St., :3334444:
Doctor Williams, 34567 Magnolia
Dr., :5556666:
```

The numbers enclosed in colons (:) are telephone numbers, which could include an area code or other extra digits. The telephone numbers are preceded and followed by a colon in the ADRS file so that they can be automatically dialed by the TELCOM program described in Chapter 5.

Now press function key F8 to get back to the main menu and we'll look at the capabilities of the ADDRSS program.

Function and Command Keys for the ADDRSS Program

Run the ADDRSS program by going to the main menu, looking to make sure that the ADRS.DO file is in the menu, moving the cursor to SCHEDL, and then pressing ENTER. The functions assigned to the various function keys are now automatically displayed at the bottom of the screen. They are:

Key F1	Find matching entries in the ADRS file
Key F3	More: display additional entries if any
Key F4	Quit: don't display additional entries
Key F5	Lfnd: find and print ADRS file entries
Key F8	All done; return to the main menu

The other function keys are not used by the ADDRSS program. Function keys F3 and F4 are only active during a Find function; the functions of these two keys are not displayed at the bottom of the screen until they are active.

Besides the eight function keys below the screen at the left you also have four command keys to the right of the eight function keys. The command keys are not used in ADDRSS. As the function keys in ADDRSS are displayed automatically, it is not necessary to use the LABEL command key to display them.

Find: Schedule Entries in the ADDRSS File

If you have just started to run the ADDRSS program, you should see function keys F1, F5, and F8 displayed at the bottom of the screen and the message "Adrs:" displayed at the top. If not, go back to the main menu, move the cursor to ADDRSS, and press ENTER.

Now press function key F1. The word "Find" appears after "Adrs:" to indicate that we are about to do a Find function. Type in the word "CHESTNUT". Immediately two lines are displayed on the screen:

```
Adrs: Find CHESTNUT
Police Department, 456 Chestnut
St., :1112222:
Fire Department, 567 Chestnut St.,
:3334444:
Adrs:
```

Notice that it makes no difference whether you type in chestnut or Chestnut or CHESTNUT; the ADDRSS program searches for both upper- and lowercase letters corresponding to Chestnut. Notice also that both occurrences of Chestnut have been found; in the TEXT program only the first occurrence would have been found and the cursor would have stopped at the first occurrence.

The message "Adrs:" after the line for the fire department indicates that ADDRSS is ready to find another combination of characters. Now press function key F1. Then type "MARY" and press ENTER. The screen immediately displays:

```
Adrs: Find MARY
Mary Madison, 123 E. 10th St.,
:3456789:
Adrs:
```

What happens if there is no match in the ADDRSS file for the word or phrase you are searching for? In that case, the "Adrs:" message is simply repeated on the next line of the screen.

Remember that there is no prescribed format for the ADRS file. You can use foreign languages, put the name or address anywhere in each entry, or leave it out entirely. ADDRSS doesn't care what material you put in the file or how you choose to arrange it. ADDRSS is only looking for a match for the particular string of characters that you typed in after hitting function key F1.

Scanning the Entire ADRS File

Now, with the "Adrs:" message on the screen, press function key F1 and then press ENTER without typing in any characters to be found. This causes everything in the ADRS file to be found and causes the entire file to be displayed on the screen. Therefore, you can scan the whole file without going back to the TEXT program to do the same thing. If you want to change the contents of the ADRS file, then you must go back to the TEXT program to type in your new entries and delete the obsolete entries.

Using the More and Quit Function Keys

Notice that, after doing a Find function that displayed all six lines of your ADRS file, the words More and Quit are displayed over function keys F3 and F4. Whenever ADDRSS has six or more lines from the ADRS file displayed on the screen, it pauses to enable you to read the six lines. Then ADDRSS gives you the choice of seeing the next six lines (by pressing function key F3 for More) or stopping the search and returning to the "Adrs:" message (by pressing function key F4 to Quit).

Using Special Symbols as Categories

Special symbols, such as asterisks and pound signs, can be used in both the ADRS and NOTE files to group and later find people or addresses by special categories such as club membership, employment, or locality. (See the special symbol explanation in Chapter 3.)

Printing Selected Entries with the Lfnd Function Key

If you have a suitable printer attached to your Model 100 (see Chapter 7 for printer information), then function key F5 will cause the entries found by the Find function to be printed on the printer instead of being displayed on the screen. All of the entries found will be printed; the Model 100 will not pause after every six lines when it is printing.

5. THE TELCOM PROGRAM

TELCOM is the name of the communications program in the ROM memory of the Model 100. It's designed to handle all the communications between the Model 100 and other computers and computer networks, whether over telephone lines or directly through cables. When you consider the many features of this program, including looking up and dialing telephone numbers and transmitting data at speeds up to 1,000 characters per second, you realize that much of the power and the cost of the Model 100 is right here in the TELCOM program and its hardware.

Unfortunately, all this flexibility makes for lots of options and lots of complexity so brace yourself. This is a tough chapter, but the rewards of mastering it are great.

BEFORE RUNNING TELCOM

Modems and Baud Rates

First a word about modems. *Modems* are hardware that translate computer data so that the data can be sent over a telephone line. The Model 100 has a built-in modem that runs at a speed of thirty characters per second. You can transmit data faster than this through a direct cable, but not if you are going over the phone lines using the modem in your Model 100.

Next a word about baud rates. *Baud rates* are the speeds at which you can send and receive data when communicating with another computer. The baud rate divided by 10 is the approximate rate in characters per second. The built-in modem on the Model 100 runs at 30 characters per second or 300 baud; when you aren't using the modem the available rates run from 75 baud to 19,200 baud.

There are three different ways to wire your Model 100 for communication. Let's describe them now.

Hooking Up to a Modem Cable

If you will be attaching your Model 100 to modular telephone lines you should use Radio Shack's Model 100 Modem Cable. This cable has three connectors to fit your telephone line, your telephone, and the connector in the back of your Model 100. The cable can be left connected to your telephone all the time; when the Model 100 is not attached a plug covers one end of the cable to permit normal telephone usage. The Modem Cable comes with one hour of connect time on each of the Compuserve and Dow Jones networks and costs only \$19.95.

When using the Modem Cable you must set the DIR/ACP switch on the left side of the Model 100 to DIR. If your Model 100 will be placing the calls (instead of receiving them), then the ANS/ORIG switch on the left side of the Model 100 should be set to ORIG.

Hooking Up to an Acoustic Coupler

If modular phone jacks aren't available, then you should attach your Model 100 to telephone lines using Radio Shack's Model 100 Acoustic Cups, which cost \$39.95. You won't find modular phone jacks at pay phone booths or some hotel telephones that are hard-wired to prevent theft. The Acoustic Cups are a pair of earmuffs on a cable that fit over the telephone mouthpiece and earphone while the cable plugs into the back of the Model 100. Although this usually works just fine, the Modem Cable is more reliable and should be used whenever you have a choice. Also, you can't do automatic dialing with the Acoustic Cups.

When using the Acoustic Cups you must set the DIR/ACP switch on the left side of the Model 100 to ACP. If your Model 100 will be placing the calls (instead of receiving them), then the ANS/ORIG switch on the left side of the Model 100 should be set to ORIG.

Hooking Up to an RS-232C Cable

If you are hooking up to an RS-232C cable it means that you are not using telephone lines at all. Instead, you are wiring your Model 100 directly to another nearby computer to upload or download information to or from the other computer. Besides the RS-232C cable on the other computer, you will need a null modem. If the null modem won't fit directly onto the other computer, you will need a cable extender to attach the null modem to the RS-232C connector on the back of your Model 100. The null modem and the cable extender each cost \$29.95.

On an RS-232C cable hookup it doesn't matter how you set the DIR/ACP switch. Set the ORIG/ANS switch on the left side of the Model 100 to ORIG.

HOW TO OPERATE TELCOM

Entry Mode and Terminal Mode

The TELCOM program operates in two different modes: Entry and Terminal.

When you run the TELCOM program you always start out in Entry mode. This mode is used to change the baud rate and other features of the communications hardware, to find telephone numbers in the ADRS file, to dial those telephone numbers, and to get into Terminal mode.

Terminal mode is used to transmit data to and from the Model 100, to review the previous screen contents

when receiving data, to echo received data to a printer, to switch between full- and half-duplex transmission, and to disconnect you from the telephone line or RS-232C cable.

Full duplex means that characters you transmit are sent and received before they appear on your screen, so that if your screen shows what you keyed in, you know that it was received correctly at the other end of the line. *Half duplex* does not provide this check. Most networks today require full-duplex transmission.

Function Keys in the Entry Mode

Now run the TELCOM program by going to the main menu, moving the cursor to TELCOM, and pressing ENTER. The following appears at the top of the screen:

```
M7I1E,10 PPS
Telcom:
```

At the bottom of the screen these function keys are defined:

Key F1	Find telephone numbers in an ADRS file
Key F2	Call: dial a telephone number
Key F3	Stat: change terminal features
Key F4	Term: go into Terminal mode
Key F8	Return to the main menu

Neither the other function keys nor the four command keys are used in the Entry mode of the TELCOM program.

Stat: Change Terminal Features

Stat allows you to review and change the terminal transmission features described by that M7I1E,10 code at the top of the screen when you first run TELCOM. Each character before the comma describes a different feature. The first character in the code is baud rate, the second is word length, the third is parity, the fourth is number of stop bits, the fifth is line status, and the two digits after the comma describe pulse rate. Table 3 lists all the Stat codes.

We are not going to define all the features in Table 3. They are included primarily to show the flexibility with which the Model 100 may be configured to match the requirements of almost any communication situation. The code of M7I1E,10 means: use the built-in modem at 300 baud with a word length of 7 bits, ignore parity, use 1 stop bit, status is XON, and pulse rate is 10 per second. The M7I1E,10 Stat code will handle most telephone line situations, including calling the Compuserve and Dow Jones networks.

For RS-232C operations directly to another nearby computer, simply change the "M" to a "6" to transmit at

TABLE 3. Stat Codes.

FEATURE	CODE	Meaning
Baud Rate:	M	Built-in modem (300)
	1	75 baud
	2	110 baud
	3	300 baud (no modem)
	4	600 baud
	5	1,200 baud
	6	2,400 baud
	7	4,800 baud
	8	9,600 baud
Word Length:	9	19,200 baud
	6	6 bits/word
	7	7 bits/word
Parity:	8	8 bits/word
	I	Ignore parity
	O	Odd parity
	E	Even parity
Stop Bits:	N	No parity
	1	1 stop bit
	2	2 stop bits
Line Status:	E	Enable (XON)
	D	Disable (XOFF)
Pulse Rate:	10	10 pulses/second
	20	20 pulses/second

2,400 baud and bypass the built-in modem. Other baud rates may be acceptable, but I have found 2,400 baud to be a good compromise between speed and absolute reliability.

To review or change the codes, press function key F3 from the TELCOM Entry mode. The message "Stat:" will appear. You may then type in a completely new code, such as 6711E,10 and then press ENTER. To review the current code settings, press function key F3 and then ENTER without typing in anything. The Model 100 will remember the current Stat codes forever unless they are changed.

Find: Look Up a Telephone Number

The Find function in TELCOM looks up telephone numbers in the ADRS file described in Chapter 4. Let's assume that your ADRS file is similar to the example ADRS file of Chapter 4 so that it contains the following line:

```
Mary Madison, 123 E. 10th St.,
:3456789:
```

From the TELCOM program, press function key F1 and type in "Mary" (with or without capital letters). Mary's name, address, and phone number now appear on the screen, and the function keys are redefined as follows:

Key F2 Call: dial the telephone number
Key F3 More: find the next matching entry
Key F4 Quit: return to TELCOM Entry mode

The More option on function key F3 allows you to look at the next Mary if there are several in your ADRS file and this one is not the one you wanted. The Quit option allows you to go back to TELCOM Entry mode without dialing any numbers.

Call: Dial a Telephone Number

If the Mary you found in the ADRS file is the person you want to call, all you have to do is press function key F2 and the number from the ADRS file, 3456789, will be dialed automatically. You must pick up the receiver of your telephone before the dialing is completed because TELCOM will hang up when it realizes that there is no computer waiting at the other end of the line.

When dialing into one of the computer networks like Compuserve, it is possible to include your network account number and password in the ADRS file so that the Model 100 can automatically dial the network telephone number and automatically log you into the network. Certain characters are given special meanings in auto log-on commands, as shown in Table 4.

TABLE 4. Auto Log-on Commands.

KEY	MEANING
?	Wait for a specified character
=	Pause for two seconds
!	Send a specific character
Shift 6	Next character is control code

An auto log-on procedure must identify various prompting messages coming from the network computer and respond with an account number and password. The Model 100 can do this very well; see the specific example near the end of this chapter.

You can also type in a telephone number and TELCOM will dial it. From the TELCOM Entry mode press function key F2 (Call) without finding a record in the ADRS file first. The message "Call" will appear on the screen. Then type in the telephone number and press ENTER. The TELCOM program will proceed to dial the number that you have just typed. As before, remember to pick up the receiver before dialing is completed.

Function Keys for the Terminal Mode

You may enter the Terminal mode by auto-dialing the telephone number of a computer or by pressing function key F4 from the Entry mode of the TELCOM program. If you get there by pressing function key F4 and there is no computer at the other end of the phone line or an

RS-232C cable, then the Model 100 will be stuck until you press the SHIFT and BREAK keys together to get back to the Entry mode.

At the bottom of the Terminal mode screen these function keys are defined:

Key F1	Prev: display previous 8 lines
Key F2	Down: download data to the 100
Key F3	Up: upload data from the 100
Key F4	Full: select full or half duplex
Key F5	Echo: print all received data
Key F8	Bye: terminate the communication

The other function keys and the four command keys are not used in the Terminal mode of the TELCOM program.

Prev: Display the Previous Eight Lines

The screen in Terminal mode can be thought of as the bottom half of a sixteen-line display. The previous eight lines of data received, or the top half of the sixteen-line display, can be retrieved on the screen by pressing function key F1. Pressing function key F1 again will show the current eight lines, or the bottom half of the sixteen-line display. This feature is useful when the information being received on the screen scrolls off the top of the screen before you have a chance to read it.

Down: Download to the Model 100

Downloading allows you to save incoming data into a RAM memory text file for later editing, printing, or running as a BASIC program. When attached directly to another nearby computer by the RS-232C cable, downloading may proceed much faster than the thirty characters per second rate of the telephone lines.

Select downloading in Terminal mode by pressing function key F2. You will get a prompting message:

File to Download?

Type in a file name of up to six characters and press ENTER. The incoming data will now go into the named file. If you run out of RAM memory, the downloading will stop but the file will contain everything received up to that point. The downloaded file may then be edited by the TEXT program as if it were any other text file.

If you want to stop downloading during the transmission, press function key F2 a second time and the downloading file will receive no more data.

Up: Upload from the Model 100

Uploading allows you to transmit text files directly from the RAM memory of the Model 100 to another computer,

either over telephone lines or at much faster speeds over the RS-232C cable.

From the Terminal mode of the TELCOM program you can select uploading by pressing function key F3. When you get the prompting message "File to Upload?", type in a file name of six characters or less and press ENTER. You will see a second prompting message: "Width:". You may then type in a maximum number of characters per line for the transmitted file. Then press ENTER. If you do not wish to restrict the line width of the transmitted file, simply press ENTER without typing in a number first. The named file will then be transmitted to the memory of the other computer.

Full: Select Half or Full Duplex

This function is included primarily for compatibility with older computers. Most networks and personal computers today expect full-duplex transmission. The Model 100 assumes full duplex and will use full duplex unless you toggle the system into half duplex by pressing function key F4. Pressing function key F4 a second time will put you back into full duplex. Don't use this function unless you know that you need it.

Echo: Print All Data Received

Echo, which doesn't show up with the other function keys on the bottom row of the screen unless it's active, will cause all incoming data to be printed if a printer is attached to your Model 100 and the printer is turned on and ready. To start printing, simply press function key F5 from the Terminal mode of TELCOM. Press function key F5 again to stop printing.

Bye: Hang Up and Stop Communication

To get out of TELCOM Terminal mode and disconnect the telephone or RS-232C lines, press function key F8. You will return to the Entry mode of the TELCOM program.

Remember that if you get stuck in Terminal mode you can get out by pressing the SHIFT and BREAK keys together. Don't do this during a data transmission if you can avoid it, because it may create problems for the computer at the other end of the line.

Using the Model 100 as a Data Transporter

The ease with which files can be uploaded and downloaded on the Model 100 to and from a variety of other makes of computers has caused many owners to use the Model 100 as a data transporter. They download the 100 with files from one computer, edit the files as needed, and then upload the files into yet another computer, using

the Model 100 as a bridge between otherwise incompatible computing systems.

Many journalists use the Model 100 to take notes during a news event, expand the notes into an article by text editing in an airplane or automobile, and finally transmit the article to a publisher by uploading the text file from a public telephone booth. That's electronic journalism!

USING TELCOM: THREE EXAMPLES

One: Logging Into a Network

A typical auto log-on entry in the ADRS file to log on to the Compuserve network might look like this:

```
CIS
:2495361<='C?U12345,678'M?
PPASSWORD'M>:
```

Looks like some sort of code, doesn't it? Here is a breakdown of the meaning of each part of the code:

CIS	Abbreviation of Compuserve Information Service
:	Indicates start of a telephone number
2495361	Compuserve number in San Jose, California
<	Indicates start of log-on message
=	Indicates two-second pause here
'C	Send SHIFT 6 C to start the log-on
?U	Wait for a U to be transmitted back
12345,678	Send account number
'M	Send SHIFT 6 M to end the account number
?P	Wait for a P to be transmitted back
PASSWORD	Send account password
'M	Send SHIFT 6 M to end the password
>	Indicates end of the log-on message
:	Indicates end of data to be sent

With the above as an entry in your ADRS file, here's what you do to log into the Compuserve network, assuming that you do have a valid account number. (The account number and password in the example above are dummies, of course.)

1. Hook up a Modem Cable to your Model 100 and phone lines.
2. Turn on the Model 100.
3. Move the cursor in the main menu to TELCOM and press ENTER.
4. Press function key F3 and change Stat to M711E,10.
5. Press function key F1 to find a phone number.
6. Type CIS and then press ENTER.

7. When the CIS entry appears on the screen, press function key F2 to call the number and log you on.

That's all there is to it!

Two: Uploading via the RS-232C

To upload a text file from the Model 100 to another nearby computer over the RS-232C cable, follow these steps:

1. Hook up the two computers with an appropriate RS-232C cable, a null modem, and possibly a cable extender.
2. Load the terminal program into the other computer and get it ready to receive data.
3. Turn on the Model 100.
4. Move the cursor in the main menu to TEL-COM and press ENTER.
5. Press function key F3 and change Stat to 6711E,10.
6. Press function key F4 to get into Terminal mode.
7. Press function key F3 to get ready to upload.
8. At "File to Upload?" type the file name and press ENTER.
9. Press ENTER in response to the "Width:" message. (transmission occurs here)
10. Press function key F8 to disconnect at the end.

Three: Downloading via the RS-232C

To download a text file from another computer to the Model 100 over the RS-232C cable, follow these steps:

1. Hook up the two computers with an appropriate RS-232C cable, a null modem, and possibly a cable extender.
2. Load the terminal program into the other computer and get it ready to send the data.
3. Turn on the Model 100.
4. Move the cursor in the main menu to TEL-COM and press ENTER.
5. Press function key F3 and change Stat to 6711E,10.
6. Press function key F4 to get into Terminal mode.
7. Press function key F2 to get ready to download.
8. At "File to Download?" type the file name and press ENTER.
9. Start transmission from the other computer. (transmission occurs here)
10. Press function key F8 to disconnect at the end.

6. USING BASIC

BASIC is the primary programming language for the Model 100. It's designed to handle the computations that you need to perform instead of the word processing, data retrieval, or communications tasks that were handled by the built-in application programs of the last three chapters.

The BASIC language was originally developed to be used on the terminals of large time-sharing networks by John Kemeny and Thomas Kurtz at Dartmouth College almost twenty years ago. Dozens of books far larger than this Guide have been written to describe dialects of the BASIC language, which has been expanded considerably over the years. We aren't going to try to make an expert BASIC programmer out of you in this chapter, but we are going to show you examples of BASIC programs and describe the features of the BASIC language on the Model 100.

A SIMPLE BASIC PROGRAM

Turn on your Model 100, move the main menu cursor to BASIC in the upper left-hand corner of the menu, and press ENTER. The following message will appear:

```
TRS-80 Model 100 Software
Copr. 1983 Microsoft
12345 Bytes free
```

The number 12345 displays the currently available RAM memory for new BASIC programs. This number will depend upon how much RAM memory you have in your machine and how many other programs and text files you have already stored in RAM.

Now type in the following short BASIC program, pressing ENTER at the end of each line:

```
10 PI = 3.1416
20 INPUT "Circle Radius"; R
30 C = 2 * PI * R
40 PRINT "Circle Circumference =
"; C
50 PRINT: GOTO 20: END
```

Check your typing for errors. If you see any errors, simply retype the whole line even if you typed other lines before noticing the error. BASIC will automatically keep the lines in sequence by the line numbers at the left of each line. When the lines look right, press function key F5 to list your program on the screen.

BASIC programs are organized into lines and each line is identified by a line number, such as 10, 20, or 30. Each line may contain several BASIC statements separated by colons; line 50 contains three such statements.

When typing in a BASIC program on the Model 100 you don't have to use capital letters for BASIC keywords like PRINT and GOTO. Lowercase letters will work, although the computer will automatically translate them to capitals after you type them in. Also, you can use spaces (or not use spaces) anywhere within a BASIC statement for increased readability.

The little program above computes the circumference of circles from their radii. Line 10 establishes the value of the constant PI. Line 20 asks for and receives the circle radius R. Line 30 calculates the circumference C from the radius. Line 40 displays the newly computed circumference on the screen. Line 50 displays a blank line and goes back to line 20 to get a new radius and repeat the whole process. The program will repeat or loop through lines 20 to 50 again and again until you stop it by pressing the SHIFT and BREAK keys together.

Notice that BASIC uses the keyword PRINT to display characters on the screen. This comes down to us from the early BASIC systems that ran only on printing terminals. To get BASIC to print on a printer, you would use the keyword LPRINT.

Now that you have typed your program into the Model 100, the next thing to do is to save the program into RAM memory. Unlike text files, which are named before you create them, BASIC program files are not saved under a name in the main menu unless you explicitly save them. To save your new program, type:

```
SAVE "CIRCLE"
```

As before, file names must be six characters or less and must start with a letter, but lowercase letters may be used. You may save only one copy of a BASIC program; attempts to save multiple copies are stymied by the "FC Error" message. Once you save a program, it will stay in RAM memory until you kill it. Future changes or program editing are saved automatically.

To run your CIRCLE program, press function key F4. You should see the following on your screen:

```
Run
Circle Radius?
```

Type in 10 for a radius value and press ENTER. Now you should see:

```
Run
Circle Radius? 10
Circle Circumference = 62.832

Circle Radius?
```

The CIRCLE program has calculated a circumference of 62.832 from the radius of 10 and is asking for another radius. After trying as many different radii as you desire, press SHIFT and BREAK together to leave the program.

Of course you may not be so fortunate as to get a running program on your first try. Instead you may see one of several different error messages, such as "SN Error in 40", which means that you have a syntax error in line 40. If so, press function key F5 to list the program, retype the offending line, then press function key F4 to run the program again. The BASIC error codes are described in the Appendix.

HOW TO OPERATE A BASIC PROGRAM

Function and Command Keys

Press the command key called LABEL just under the screen. The functions assigned to the various function keys are now displayed at the bottom of the screen. They are:

Key F1	Files: display all user file names
Key F2	Load a BASIC program
Key F3	Save a BASIC program
Key F4	Run a BASIC program (if one is loaded)
Key F5	List the statements in a BASIC program
Key F8	Return to the main menu

The unused function keys F6 and F7 can be defined for other functions (such as Edit) by using the KEY command. For example, to make function key F6 into an Edit key, type:

```
Key 6,"Edit"
```

Besides the eight function keys below the screen at the left, you also have four command keys to the right of the eight function keys. The command keys used in BASIC are labeled as follows:

LABEL	Causes display of function key labels
PRINT	Prints the screen (if printer attached)
BREAK	Interrupts the current BASIC program

The LABEL key can be pressed whenever you are unsure of the purpose of one of the function keys. Pressing LABEL again will remove the function key label display to create more space on the screen.

The PRINT key prints the contents of the Model 100 LCD screen upon a printer, if a printer is attached and ready.

The BREAK key (press SHIFT to get BREAK) interrupts any BASIC program currently running, so that you can display the current values of any variables (like R or C in the CIRCLE program). This is very helpful when a program is getting incorrect answers and you need to see what numbers the program was using in its calculations. To display the value of the radius R after

BREAKing, type "?R" and press ENTER, and the current value of R will be displayed. To restart the program from the point of interruption, type "CONT" and press ENTER to continue the program.

The PAUSE key (the BREAK key with no SHIFT) simply stops the program so that you can read the screen, if it is scrolling too fast. Press any key to continue after pausing.

Files: Display User's File Names

Pressing function key F1 displays all the user-created files on the screen, so that you can select which BASIC program you want to run. Notice that the text file names are followed by ".DO" and the BASIC file names are followed by ".BA", so you see MEMO.DO, NOTE.DO, ADRS.DO, and CIRCLE.BA on the screen. The Files function can be included inside a BASIC program by using the FILES statement.

Load a BASIC Program from RAM Memory

Pressing function key F2 causes the message

```
Load "
```

to appear on the screen. All you have to do is type in the name of your program, such as CIRCLE, and press ENTER. Lowercase letters are acceptable for the file name. The command:

```
Load "circle",r
```

will cause the program to begin running after it is loaded. However, a quicker way to get CIRCLE running is to select CIRCLE directly from the main menu.

If you have a BASIC program in a text file because you just received it over the telephone from another computer, you can still load it, but you will be asked to wait while the Model 100 translates it into the more compact BASIC language notation.

The Load function can also load BASIC programs from cassette tape, the telephone modem, or the RS-232C interface. Details of these operations are in the owner's manual.

Save a BASIC Program into RAM Memory

Pressing function key F3 produces the message:

```
Save "
```

All you need to do is type in a file name, such as CIRCLE, and whatever BASIC program you are currently editing or running will be saved into RAM memory. If you want to save your program as a text file, the command:

Save "Circle",a

will do the job. Again, lowercase letters are OK.

Note that you can't save the same file name repeatedly; you must save it once, and after that it is saved automatically even if you change it by editing.

Like the Load function, Save can save your program to cassette tape or over the telephone modem or RS-232C interface.

Run a BASIC Program

Press function key F4 and the program you have loaded will start running. If you haven't loaded any program recently, the last program that you did load will begin to run, even if you loaded it days before!

Remember that you can stop a BASIC program at any time by pressing the SHIFT and BREAK keys together.

Running a new program will usually produce some of those delightful BASIC error messages. To fix them, you need the List and Edit functions described below.

List the Statements in a Program

Press function key F5 and every line of the currently loaded BASIC program will be displayed on your screen. As with the Run function, if you haven't loaded a BASIC program recently the Model 100 will still remember and list the last program that you did load, even if that was days ago. Type NEW to clear the way for a new program.

To stop the listing at any line, press the PAUSE key. Press PAUSE again to continue the listing.

To list a specific program line or lines, type in:

```
List 20
```

or type in:

```
List 20-30
```

and then press ENTER. The first example, List 20, will list program line 20 only. The second example, List 20-30, will list lines 20 through 30.

Edit the Statements in a BASIC Program

A single program line, a range of lines, or the entire BASIC program can be edited by the Model 100 text editor. This provides a more powerful and convenient way to change program lines. Remember that so far we have changed program lines by retyping the whole line. To edit lines 20 through 30, type:

```
Edit 20-30
```


and then press ENTER. The screen will clear and the specified lines will appear at the top of the screen. You can then insert or delete characters and select, cut, paste, or copy strings of characters. To leave the text editor, press function key F8 and you will return to BASIC.

If you type Edit with no line numbers, the whole program, not just a few lines, will appear on the screen to be edited. When you press function key F8 to return to BASIC, you will be asked to wait while the program is translated into the BASIC program format, which could take several seconds.

Kill or Erase a Program or Text File from RAM

To kill any program or text file, get into BASIC from the main menu and then type:

```
Kill "circle.ba"
```

and then press ENTER to erase the BASIC file called CIRCLE from RAM memory. Since killing is serious business, you are required to include the ".BA" or ".DO" at the end of the file name to prove that you know what you're doing. Remember, after you kill a file it's really dead and you can't get it back again, unless you've saved a copy of it on a tape cassette or elsewhere.

ADVANCED FEATURES OF MODEL 100 BASIC

The Model 100 BASIC language contains many features that make it superior to the BASIC languages of previous TRS-80 computers and those of most other personal computers as well. Here is a brief explanation of these advanced features.

Although significantly faster than the TRS-80 Model III in almost everything except scrolling the screen, the Model 100 performs BASIC calculations to a much higher degree of precision and accuracy than does the Model III. A full fourteen digits of accuracy are used in Model 100 calculations, compared to six or seven digits for normal precision on the Model III. This makes for considerably more accuracy in navigation problems involving trigonometry, for example. This accuracy, combined with the portability of the Model 100, makes it an ideal machine for such problems.

Two new arithmetic operators, the backslash and the MOD function, are provided for the Model 100. The backslash returns the quotient of an integer division; for example, seven backslash two equals three. The MOD function returns the remainder of an integer division: seven MOD two equals one.

MAXRAM is a new function that returns the size of the RAM memory installed in your Model 100. CRSLIN returns the line on the screen where the cursor is cur-

rently located. POS returns the column position of the cursor, while LPOS returns the current character position of the printer within a line to be printed.

Another major step forward in Model 100 BASIC is the use of logical file assignments. In general, any file in RAM, as well as any device such as the cassette recorder, modem, RS-232C, LCD screen, or printer, may be opened as a file that can be read from or written into. The result is that data can be read from and written to practically any place in the system with an ease and flexibility that puts much more expensive systems to shame.

An advanced family of interrupt commands are available to take action when errors occur, when data is received at the modem or RS-232C interface, or when the real-time clock reaches a programmed time of day. This capability can be combined with the communications features to enable you to write short programs in BASIC that will place phone calls at programmed clock times to get information from computer networks and either print the information or log it away on RAM or cassette files. Most of these capabilities are still pure science fiction for other personal computers, regardless of the ingenuity of their owners. The Model 100 can do this in a few lines of BASIC programming.

A final unique BASIC feature is the eight programmable function keys. The KEY command allows you to tailor the function keys to do what you want them to do in a single keystroke. Examples are displaying the time of day or the date, invoking the Edit command for text editing from BASIC, or invoking the Kill command to erase files.

Graphics Capabilities in BASIC

BASIC on the Model 100 includes a powerful LINE command, which can draw line segments or enclosed boxes with a single command. The boxes may be hollow or may be filled solid. The Model 100 screen consists of dots or pixels that are either dark (on) or light (off). The pixels are arranged in 64 horizontal rows of 240 pixels per row, for a total of 15,360 pixels on the screen. Each pixel can be turned on and off separately with the PSET and PRESET commands in BASIC. These graphics operations are quite fast, and the box option in LINE makes drawing bar charts a snap.

One graphics limitation: there is no way to find out if a specific pixel is on or off by testing it. This makes it hard to fill irregular shapes because you can't tell when you've reached the shape boundary.

Music Capabilities in BASIC

The SOUND command in BASIC emits a sound of specified pitch and duration. This command can be used to play music in one-part harmony over a range of five octaves. Fairly simple programs can be written to read and play notes like C, C#, D, D#, E, complete with

half notes, quarter notes, eighth notes, and the rest. Although the music sounds a little tinny, the capability is built into every Model 100 and you can use it, for example, in airplanes while running on the batteries.

A TEXT FORMATTER FOR PRINTERS

Now let's look at a serious and possibly useful BASIC program. As we pointed out in Chapter 2, one of the limitations of the text editor on the Model 100 is its lack of formatting for printers. Ideally, we would like to be able to specify left and right margins, top and bottom margins, page numbering, titles on each page, date stamping, and other things. All of this can be done by the following program.

The program must avoid splitting words at the end of a line. This is done by building words out of characters one by one, and only adding a word to the current line if there is room on the line.

The following are the important variable definitions:

BM	Bottom margin in print lines
C\$	The current character
CR\$	Code for a carriage return (13)
EF\$	Code for end of file (0)
L\$	The current print line
LL	Line length (page width less margins)
LM	Left margin in characters
LP	Lines per page (usually 66)
M\$	Left margin spaces
N0	Equals 0
N1	Equals 1
N\$	An empty character string
PC	The page count
RM	Right margin in characters
S	Line spacing, single (1) or double (2)
SP\$	Code for a space character
TM	Top margin in print lines
W\$	The current word

In lines 1-5 below, the program establishes the variables just described. All variables are defined as integers. The margin and line-spacing variables in line 3 can be changed by editing new values into line 3 of the program.

```
1 'XPRINT, © BOB LOUDEN, 1984.  
2 DEFINT A-Z: CR$=CHR$(13)  
3 LM=12: RM=72: TM=6: BM=6:  
  LP=66: S=1  
4 EF$=CHR$(0): SP$=" ": LL=RM-LM  
5 M$=SPACE$(LM): N0=0: N1=1  
  N$=" "
```

In lines 9-14 the lines from the main menu are displayed and the program reads the file name and the document title from the keyboard. The file is opened. The page count is set to zero, the character and word

variables are set to empty strings, and the subroutine at 70 heads up the first page.

```
9  ' -----New File:
10 CLS: FILES: PRINT
11 INPUT "Text File to be
    Printed"; F$
12 OPEN F$ FOR INPUT AS 1
13 INPUT "Document Title"; T$
14 PC=N0: C$=N$: W$=N$: GOSUB 70
```

In lines 19–22 the new line is initialized with the left margin spaces. If the last character read was a carriage return or an end of file, then we go to line 40 to end the line; otherwise we read the next character at line 80 and store away all spaces at the left end of the print line.

```
19 ' -----New Line:
20 L$=M$: IF C$=CR$ OR C$=EF$
    THEN 40
21 GOSUB 80: IF C$=SP$ THEN 21
22 IF C$<SP$ THEN 40
```

In lines 29–32 we read more characters at line 80 and store away the word complete with trailing spaces, if any.

```
29 ' -----New Word:
30 GOSUB 80: IF C$>SP$ THEN 30
31 IF C$<SP$ THEN 40
32 GOSUB 80: IF C$=SP$ THEN 32
```

In lines 39–46 we have reached the end of a word. If the word is longer than an entire line, it is truncated to the length of a line. If space permits, the word is added to the current line. If we are at the end of the file, the subroutine at line 60 spaces out the page. If we read a carriage return, we skip the next character (GOSUB 81) because we know it is a line feed. Then we erase the carriage return.

```
39 ' -----End Word:
40 IF LEN(W$)>LL THEN W$=LEFT$
    (W$,LL)
41 IF LEN(L$)+LEN(W$)>LL+LM THEN
    50
42 L$=L$+W$: W$=N$: IF C$<>EF$
    THEN 45
43 LPRINT L$: LC=LC+N1: GOSUB 60
44 CLOSE 1: GOTO 10
45 IF C$<>CR$ THEN 30
46 GOSUB 1: C$=N$
```

In lines 49–53 we check to see if we are at the bottom of the page. If so, we space to the bottom of the page (GOSUB 60) and head up the next page (GOSUB

70). We print the line and space between lines if $S=2$. Then we start a new line at line 20.

```
49 ' -----End Line:
50 LC=LC+S: IF LC<=LP-BM THEN 52
51 GOSUB 60: GOSUB 70
52 LPRINT L$: IF S>N1 THEN LPRINT
53 GOTO 20
```

In lines 59–61 we handle the end of a page by spacing down enough lines to get to the bottom of the page.

```
59 ' -----End Page Subroutine:
60 FOR I=LC+N1 TO LP: LPRINT:
  NEXT I
61 RETURN
```

In lines 69–74 we handle the top of a new page by spacing down past the top margin and then printing the title, the date, and the new page number.

```
69 ' -----New Page Subroutine:
70 FOR I=N1 TO TM: LPRINT: NEXT I
71 LPRINT M$;T$: PC=PC+N1: LC=TM
  +4
72 LPRINT M$;DATE$;"      Page";PC
73 LPRINT M$;STRING$(LL,"-"):
  LPRINT
74 RETURN
```

In lines 79–82 we read a new character from the text file after saving the previous character in the current word W\$.

```
79 ' -----New Character Sub-
  routine:
80 W$=W$+C$
81 IF EOF(N1) THEN C$=EF$: RETURN
82 C$=INPUT$(N1,N1): RETURN: END
```

The above program provides fairly complete print formatting for a variety of text files. Type the statements into your Model 100 and try it. Then study the program listing to see how the formatting is accomplished.

To save space, all the lines with line numbers ending in 9 may be deleted from the program.

A COMPLETE LIST OF BASIC KEYWORDS

Here are the BASIC keywords for computation:

ABS	Returns absolute values
ASC	Converts characters into ASCII character codes
ATN	Returns a trigonometric arc tangent
CALL	Calls a subroutine in ROM
CDBL	Converts numbers to double (14-digit) precision
CHR\$	Converts ASCII character codes into characters
CINT	Returns largest integer not greater than a number
CLEAR	Makes space for string variables and programs
CONT	Continue after a BREAK or STOP command
COS	Returns a trigonometric cosine
CSNG	Converts numbers to single (6-digit) precision
DATA	Lists constants to be read by a READ statement
DATE\$	Returns the current date
DAY\$	Returns the current day of the week
DEFDBL	Defines double precision variables
DEFINT	Defines integer variables
DEFSNG	Defines single precision variables
DEFSTR	Defines string variables
DIM	Defines array variables
EDIT	Does text editing on BASIC program lines
END	Stops the program at the end of the program
ERL	Returns the line number of an error
ERR	Returns the error code number of an error

ERROR	Simulates a specific error number
EXP	Returns the exponential (antilog) of a number
FIX	Returns the whole number part of a number
FOR, STEP, NEXT	Controls repetitive program loops
FRE	Returns the amount of free or unused RAM memory
GOSUB	Branch to a subroutine
HIMEM	Returns highest address available to BASIC
IF, THEN, ELSE	Branch on true/false conditions
INP	Returns data from an input port
INSTR	Matches characters in strings of characters
INT	Returns the integer part of a number
LEFT\$	Returns characters from the left side of a string
LEN	Returns the length of a character string
LET	Optional first word in assignment statements
LOG	Returns the natural log of a number
MENU	Returns to the main menu
MID\$	Returns characters from the middle of a string
NEW	Sets up BASIC for a new program
ON ERROR	Branches on an error condition
ON TIME\$	Branches on a particular time
ON, GOSUB	Branches to a subroutine in a list
ON, GOTO	Branches to a line number in a line number list
OUT	Sends data to an output port
PEEK	Returns data from a memory address
POKE	Puts data into a memory address
POWER	Sets the "power off if not used" timer
POWER CONT	Disables the power-off timer

POWER OFF, RESUME	Turns off power immediately
READ	Reads data from a DATA statement
REM	This line is a remark or comment
RESTORE	Next READ will be at first DATA statement
RESUME	Exits an error handling subroutine
RETURN	Ends a subroutine by returning to GOSUB statement
RIGHT\$	Returns characters from right end of a string
RND	Returns a random number between 0 and 1
RUN	Starts running the program
SGN	Tests the sign of a number
SIN	Returns a trigonometric sine
SPACE\$	Returns a string of space characters
SQR	Returns the square root of a number
STOP	Stops execution of a program
STR\$	Converts numbers to character strings
TAN	Returns a trigonometric tangent
TIME\$	Returns the time of day
TIME ON, OFF, STOP	Turns on or off the ON TIME\$ interrupts
VAL	Converts a character string to a number
VARPTR	Returns the memory address of a variable name

Here are the BASIC keywords for the keyboard:

INKEY\$	Returns the character of the current keystroke
INPUT	Prompts and reads keyboard data
INPUT\$	Returns a string of characters from the keyboard
KEY	Defines function key operations
KEY LIST	Lists current function key definitions
KEY ON, OFF, STOP	Enables or disables the function keys

LINE INPUT	Reads a character string from the keyboard
ON KEY GOSUB	Assigns subroutines to function keys

Here are the BASIC keywords for the LCD screen:

CLS	Clears the screen
CLOSE	Closes files previously opened
CSRLIN	Returns the line number of the cursor
LCOPY	Prints text from the screen
LINE	Draws a line or box on the screen
LIST	Lists all or part of a program
MAXFILES	Stores the maximum number of files for a program
OPEN "LCD:"	Assigns a file to the screen
POS	Returns the column number of the cursor
PRESET	Turns off a specified screen pixel.
PRINT	Displays data on the screen at the cursor
PRINT @	Displays data at a specified place on the screen
PRINT USING	Displays formatted data on the screen
PSET	Turns on a specified screen pixel
SCREEN	Turns the LABEL line on or off
TAB	Tabs across the screen

Here are the BASIC keywords for printers:

LCOPY	Prints the contents of the screen (text only)
LLIST	Lists the current program on the screen
LPOS	Returns current position in the print line
LPRINT	Prints data on the printer
LPRINT USING	Prints formatted data on the printer

Here are the BASIC keywords for RAM memory files:

CLOSE	Closes one or more RAM files
EOF	Tests for end of file

IPL	Picks a program to run when computer is turned on
KILL	Erases a RAM file
LOAD	Loads or gets a RAM file to be run
LOADM	Loads a machine-language file from RAM
MERGE	Merges a file with an existing program
NAME	Renames RAM files
OPEN	Opens a RAM file
RUN	Runs a RAM program file
RUNM	Runs a machine-language file in RAM
SAVE	Saves a program into a RAM file
SAVEM	Saves a machine-language program into a RAM file

Similar commands exist for modem and RS-232C files. Here are the BASIC keywords for cassette recorders:

CLOAD	Loads a program from a tape cassette
CLOADM	Loads a machine-language program from tape
CSAVE	Saves a program onto a tape cassette
CSAVEM	Saves a machine-language program onto tape
MOTOR ON	Starts the cassette recorder motor
MOTOR OFF	Stops the cassette recorder motor

And, finally, here are the BASIC keywords for music:

BEEP	Makes a "beep" noise for half a second
SOUND	Sounds a note of specified pitch and duration
SOUND OFF	Disables beeps from cassette and modem operations
SOUND ON	Enables beeps from cassette and modem operations

7. ACCESSORIES

Sooner or later you are bound to want printed output for your Model 100. When that time comes, what sort of printer should you choose?

In this chapter we are going to look at a variety of Radio Shack printers and other accessories for use with the Model 100. Other printers by other manufacturers will work well with the Model 100, but the Radio Shack line includes almost all printer configurations at competitive prices. And Radio Shack has one other advantage from your point of view: if one of their printers won't work with the Model 100, they'll find out why and fix the problem. If someone else's printer won't work with the Model 100, it won't be obvious whose machine has the problem or who should fix it.

To attach any of the printers described below you will also need the Model 100 printer cable at \$14.95.

DOT MATRIX PRINTERS

Dot matrix printers are the most popular type of printer for use with personal computers, and for some very good reasons. As a group they are inexpensive, lightweight, fast, quiet and relatively free from vibration. Their print quality is not as high as the print quality of the daisy wheel printers discussed below, but the quality is usually adequate, unless you want that "typed by hand on an IBM typewriter" look, which only the daisies can supply.

How Dot Matrix Printers Work

The characters printed by a dot matrix printer are formed by a pattern of dots. Each dot is caused by the end of a fine wire pressing a ribbon against the paper. The wires are carried across the paper to print sixty to eighty dots per inch both horizontally and vertically.

The closely spaced dots can be used to draw graphs and pictures as well as characters, and the advertising for these printers frequently shows them drawing complex shapes. Unfortunately, the graphics capability would be hard to program on the Model 100, because these printers can only print a picture from the top of the page to the bottom. They cannot draw one line of a picture down to the bottom of a page and then go back to the top of the page to draw another line. As a result, the entire picture has to be laid out in RAM memory so that it can be printed top to bottom, and this job is too hard to do in BASIC. Assembly language or FORTRAN, languages not currently available for the Model 100, are necessary for dot matrix graphics.

Dot Matrix Printer Models

Radio Shack currently sells six different dot matrix printers, called DMPs, at six different prices. As the prices go up you get more speed, more rugged construction, and, in some cases, more precisely formed characters.

The lowest cost dot matrix printer is the DMP-100, which prints an eight-inch-wide line at up to fifty characters per second. It costs \$399.00 and weighs eight pounds.

Next is the DMP-120, which prints an eight-inch line at up to 120 characters per second, costs \$499.95, and weighs sixteen pounds. The extra speed is probably worth the extra hundred dollars.

The best of the eight-inch DMPs is the DMP-200, which includes all of the features of the DMP-120 plus a correspondence mode, which produces denser characters for letters and reports. It costs \$699.00 and weighs sixteen pounds. You should get a demonstration of the correspondence mode to see if its higher print quality is worth it in your applications.

The remaining three DMP printers all print a thirteen-inch line and can handle wide data processing reports and forms in several different widths. These DMPs are bigger and heavier than the eight-inch DMPs, but they are faster, slightly quieter, and more rugged.

The least expensive of the thirteen-inchers is the DMP-420, which prints up to 140 characters per second and also has a high-density correspondence mode. It costs \$999.00 and weighs sixteen pounds.

Next is the DMP-500, which prints up to 220 characters per second bi-directionally, making it the fastest printer in Radio Shack's lineup. Bidirectional printing means that the printer reverses direction to print one line left to right and the next line right to left, thus eliminating the time needed for the print head to return to the left margin after each line. If you have high-volume printing requirements, the DMP-500 is the answer. It costs \$1,295.00 and weighs a hefty fifty pounds.

Top of the DMP line is the DMP-2100, which contains more wires in its print head to produce the highest quality printing of any DMP. The quality of daisy wheel printing is still slightly higher, though. The DMP-2100 prints up to 160 characters per second, costs \$1,995.00, and weighs forty-two pounds.

DAISY WHEEL PRINTERS

The daisy wheel printers, called DWPs, provide the highest print quality available. As a group these machines are expensive, heavy, bulky, relatively slow, and noisy. They create so much vibration that you should never run one on the same table as your computer. But they are ruggedly built and you can't beat the print quality.

How Daisy Wheel Printers Work

Daisy wheel printers print characters by pressing an inked ribbon into the paper, just like the dot matrix printers. The difference is that the daisies hit the ribbon with a fully formed type slug for each separate character, not a pattern of wires to make dots. The type slugs are at the ends of the spokes spread around the circumference of a circle, like the petals of a daisy; hence the name. The result is a slower, more complex mechanism, but the characters look just like the characters printed by an expensive typewriter.

Daisy Wheel Printer Models

The lowest cost daisy wheel printer from Radio Shack is the DWP-210, which prints up to eighteen characters per second on an eleven-inch line, costs \$799.00 and weighs thirty-eight pounds. Notice the much slower speed than any of the dot matrix printers.

Next is the DWP-410, which prints up to twenty-five characters per second on a thirteen-inch line. It costs \$1,295.00 and weighs thirty-five pounds.

Top of the DWP line is the Daisy Wheel II, which prints up to forty-three characters per second on a thirteen-inch line. It costs \$1,995.00 and weighs twenty-eight pounds.

PEN PLOTTERS

How Pen Plotters Work

As a group the pen plotters provide color graphics that are easily programmed on the Model 100. Why? Because pen plotters can move up and down the page; they don't have to print everything left to right and top to bottom. As a result, the pictures they draw can be programmed one line at a time in BASIC and the whole picture doesn't have to be laid out in memory before it is printed.

As for printing characters, the pen plotters are even slower than daisy wheel printers. But they are inexpensive, quiet, small, and lightweight. One of them appears to be a "best buy" for use with the Model 100.

Pen Plotter Models

The "best buy" in pen plotters is the CGP-115, which costs only \$199.95. It's even smaller than the Model 100 and weighs less than two pounds, so it's about as portable as the Model 100 except that it runs on 120-volt power. It does character printing at the slow speed of twelve characters per second, but it also draws attractive, accurate graphs and pictures rapidly in four colors. It even changes colors automatically under program control. The CGP-115 prints on roll paper four-and-a-half inches wide

and prints forty or eighty characters per line. If you don't need "typewriterlike" printing, this might be your best choice for a printer.

Next is the FP-215, a flatbed pen plotter that takes eight-and-a-half by eleven paper. The pictures drawn by the FP-215 are accurate and attractive, but color pen changes are manual. A rugged plotter, it costs \$995.00 and weighs twenty-two pounds.

INK JET PRINTERS

Perhaps the most advanced printer in Radio Shack's entire line is the CGP-220 ink jet printer, which prints colored dots in seven colors at a resolution of eighty dots per inch, both horizontally and vertically. This printer produces better-looking color pictures and graphs than any of the other printers or plotters and prints characters at thirty-seven characters per second on an eight-inch line.

How Ink Jet Printers Work

Ink jet printers squirt jets of ink through tiny nozzles onto the paper. Each squirt produces one dot of colored ink on the paper at speeds up to 2,600 squirts or dots per second. Various combinations of three primary colors are used to produce seven different colors on the paper.

Unfortunately, like the dot matrix printers described above, the CGP-220 would be hard to program for graphics on the Model 100 because it only prints top to bottom on the page. The picture would have to be laid out in RAM memory before printing. However, you could use it to print memos in seven different colors. It is a relative bargain at \$699.00.

OTHER ACCESSORIES

Cassette Recorders

As described in Chapter 1, the CCR-81 cassette recorder has the remote controls necessary for use with the Model 100 as a secondary memory storage device. Although somewhat bulky by today's standards, the CCR-81 runs on batteries so that it can operate anywhere that the Model 100 can. The CCR-81 costs \$59.95. You will also need a cassette cable at \$5.95, as well as some blank cassette tapes.

Traveling Case for the Model 100

A rugged, briefcase-sized black plastic case, which holds the Model 100 together with a CCR-81 cassette recorder, some cassettes, spare batteries and cables is available for \$49.95. It measures twenty by fourteen by four inches. It looks inexpensive, but who needs an expensive-looking

case to attract thieves in airports and train stations. It's probably worth getting if you do a lot of traveling with your Model 100.

Direct-Connect Modem Telephone Cable

The direct-connect Modem Cable, at \$19.95, is almost a "must buy" for any Model 100 owner. This cable, described in Chapter 5, comes with one hour of free time on the CompuServe network and the Dow Jones information network. Essentially, you get the cable, which allows you to plug your Model 100 into any phone line with modern modular plugs, for free.

Model 100 Acoustic Coupler

If you travel to many hotels or call computer networks from public telephone booths, then you need the Model 100 acoustic coupler. This consists of a pair of ear muffs to slip over a telephone receiver, if you can't unplug it to use the direct connect modem cable. Not too elegant, but it does the job nicely for \$39.95.

Bar Code Reader

A bar code reading wand is available for the Model 100 from Radio Shack for \$99.95 to read encoded prices and inventory control information. Bar codes, which have become so familiar in supermarkets, may be used in the future to distribute programs. If so, you will be able to read such programs with the wand. You would also be able to duplicate the programs on an office copier. Although at present there are few programs available in bar code format, here, as in so many other areas, the Model 100 is a pioneer.

Disk Video Interface

The disk video interface at \$799 includes one 184K byte five inch floppy disk drive with a television adapter. A second disk drive may be added for \$239. The television adapter permits big screen viewing: 24 lines of 40 characters each. If you get a TV monitor you can display 24 lines of 80 characters each.

APPENDIX. BASIC ERROR MESSAGES

The Model 100 displays the following two-letter messages to indicate various errors in BASIC programming:

CODE	MESSAGE	MEANING
1	NF	NEXT without a FOR
2	SN	Syntax error
3	RG	RETURN without a GOSUB
4	OD	Out of DATA
5	FC	Illegal function call
6	OV	Arithmetic overflow
7	OM	Out of memory
8	UL	Undefined line number
9	BS	Bad subscript
10	DD	Doubly dimensioned array
11	/0	Division by zero
12	ID	Illegal direct command
13	TM	Variable type mismatch
14	OS	Out of character string space
15	LS	Character string too long
16	ST	String formula too complex
17	CN	Cannot continue
18	IO	Input/output error
19	NR	No RESUME statement
20	RW	RESUME statement but no error
21	UE	Undefined error
22	MO	Missing operand
50	IE	Undefined error
51	BN	Bad file number
52	FF	File not found
53	AO	File already open
54	EF	Input past end of file
55	NM	Bad file name
56	DS	Direct statement in file
57	FL	Undefined error
58	CF	File not opened

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